

a. m. the sun shone through this cloud, dissipating it temporarily. On December 3, a similar light was observed at about the same hour, but the cloud was denser and was not subsequently dissipated.

Mr. Brooks's photograph is the first that we have seen illustrating the delicate illumination of the under surface of a cloud at sunrise or sunset. But such phenomena are very common and always excite admiration during sunsets in the eastern portion of the United States. They are especially brilliant when the sky is clear in the distant west so that as the sun disappears below the horizon in a dry, clear air his beams, for a few minutes strike upward on the under surface of a broad layer of clouds. Under these conditions, the observer sometimes sees long streaks of gorgeous colors, at other times symmetrical arrangements of bright spots, both of which show that the under surface of the cloud is not a smooth and uniform surface, but is sometimes thrown into waves, the lowest limits of which are illumined by the sun; at other times it is thrown into irregular dimples and is full of masses of denser cloud distributed among the lighter and rarer material.

From an artistic point of view photographs of these sunset illuminations have much interest, but from a meteorological point of view still more. One of the oldest methods of determining the height of the clouds consists in measuring the angular altitude and azimuth of a cloudy point that is just on the border between the dark section of the sky and the illumined portion. By noting the time exactly, one is able to compute the apparent position of the upper limb of the sun, and by assuming that the light from the upper limb is that which, grazing past the edge of the spherical earth, last falls upon the cloud, one can easily calculate the point at which this line intersects the line of sight of the observer and, therefore, the point at which the clouds must exist. Special tables to assist in this calculation were published by Zenker in his Meteorological Calendar for 1887. The method in general was proposed by James Bernoulli in 1744, and was extensively applied by Liais in 1854, but in its application one must be very sure that the beam of light from the sun grazes the surface of the ocean or the lower level planes of the earth's surface and not the tops of clouds or mountains.

If such beautiful photographs as those of Mr. Brooks could be accompanied by two necessary items, namely, the exact second of the correct time and a scale of angular altitude and azimuth, then Bernoulli's method could be applied to a large surface of alto-stratus cloud and would give us much information with regard to its altitude and its irregularities.

DISTANT THUNDER.

The Rev. J. J. Abell, of the Bethlehem Academy, St. John, Ky., makes the following interesting observation:

On the evening of January 12, 1899, at 7:07, central time, the writer observed lightning to the northwest. He began counting seconds, but ceased counting after a minute and a half had elapsed without audible thunder. Low and heavy thunder began rolling in the northwest upward of a minute later. This was so remarkable that with watch in hand he awaited a repetition of the lightning.

At 7h. 11m. 05s. he observed a flash that illumined a band along the northwest horizon about 50° long and 10° wide. At 7h. 13m. 45s. came the heavy, low, but unmistakable roll of thunder, again from the northwest.

The air was perfectly calm, and its temperature 49° F. The geographical position of the observer was latitude, 37° 42' north; longitude, 86° 00' west (Greenwich).

Mr. Abell remarks that the above interval of 160 seconds, with an air temperature of 49°, corresponds to a distance of 33.6 miles. This observation is interesting in connection with the statement made in many text-books that an interval of longer than eighty seconds is rarely or never observed.

A NEW STYLE OF ANEROID.

According to a circular received from Mr. Edward Whymper, a modified form of aneroid has been invented by Col. H. Watkins, of the British Army, which has given better results in the hands of surveyors and mountaineers than any other thus far tried by Mr. Whymper. The instruments of this kind are now made by Mr. J. J. Hicks and will be known as Watkins' Mountain Aneroids.

Mr. Whymper states that all aneroids, when carried to higher points in the atmosphere, lose with respect to the mercurial barometer, that is to say, read lower than it. When tested under the receiver of an air pump, when the pressure is diminished rapidly, the aneroid will, in a short time, read lower than the mercurial even though they may agree exactly at the first minute. The greater the length of time that the aneroid is kept under low pressure so much the greater is the loss. It appears, moreover, that when returning to the normal pressure at sea level the aneroid will, in the course of time, recover all its previous loss and read correctly.

Manufacturers and inventors have endeavored to diminish these errors. The former have attempted to abolish the fundamental cause, and the latter to shorten the length of time that the corrugated disks are exposed to the influence of the low pressure.

The Watkins aneroid is so constructed that the corrugated disk is put in action when required and thrown out of action when it is not wanted for use. In order to accomplish this the lower portion of the vacuum box, instead of being a fixture, is free to rise, thus relieving it of any strain. When a reading is required, a fly-nut is screwed up as far as it will go, thus bringing the instrument into the normal condition in which it was graduated.

Actual comparison between aneroids and mercurials throughout Switzerland in 1898 seems to show that the new form of aneroids is about as good as the mercurial barometer itself. It is very unfortunate that the new instrument does not easily lend itself to continuous registration as in the case of the ordinary aneroid.

LOW PRESSURES AND TIDAL WAVES.

Mr. H. C. Russell of Sidney, New South Wales, is said to have proved that of the so-called tidal waves observed near that place only 1 per cent is produced by seismic disturbances, while 60 per cent is due to low pressures producing waves in the South Pacific.

A tidal wave, as we have said in the MONTHLY WEATHER REVIEW for 1896, must not be confounded with a wind wave or waves produced by earthquakes. The use of the term tidal is oftentimes quite improper and unwarranted. The great waves that are reported on the Australian tide gauges may be due to heavy winds, but there is no reason to think they are due to special tidal action.

FLOATING SPIDER WEBS.

A paragraph in the Advertiser of Montgomery, Ala., states that on November 21, numerous batches of a spider-web substance were seen floating in the air and falling from the trees and leaves to the ground. Some of it was in films 15 or 20 feet long, but occasionally masses a few inches in length and an inch or more broad were observed. The author of the paragraph states that it was not spider web but resembled fine fibers of asbestos, and that it was probably connected with the fall of November meteors. It is also said to have shown a phosphorescent effect.

As there are several species of spiders that float indefi-

nately through the air by means of their delicate webs, the Editor sees no reason to think that the above-mentioned phenomenon was of any other nature. It does not seem possible that the burning up of meteors could in any way have produced these delicate webs.

THE BAROGRAPH ON SHIPS.

Mr. H. W. Richardson, local forecast official, Weather Bureau, at Duluth, Minn., published in the Evening Herald of January 3, 1899, an interesting account of the efforts made by the Weather Bureau to increase the safety of navigators by introducing the barograph into daily use. He says the first barograph used on the Lakes was placed by the Weather Bureau in 1892 on the steamer *J. D. Moran*. The record sheet gives practically the record of the ship's course, with the air pressure, the wind, and the state of the weather during her whole trip. The prime object of placing the barographs in the hands of navigators was to educate them in the practical use of the barometer in connection with the daily weather map.

During the present season, navigators on the Great Lakes who have used these instruments say that they have received great benefit from watching the action of the barometer.

Of the forty navigators who used the barograph during the present season, only three have said that its use was not of sufficient importance to them to be further desired.

WEIGHTS AND MEASURES IN PORTO RICO.

As there seems to be some little discrepancy between the weights and measures legalized by Spanish law and those actually in use in Porto Rico and other Spanish colonies, the Editor has collected the following recent information on this subject from the following authorities.

(1.) In a letter from Señor Antonio Mattei Lluveras, author of a recent work on Porto Rico, the following statement is made:

* * * In my letter of the 2d, from which I quote, I told you that a "cuerda," an agricultural measure of Porto Rico, represents a surface of 75 varas in length and 75 varas in breadth, or 5,625 square varas of level surface, which is equal to 39 ares, 30 centiares, and 39 miliares.

In reply to your question, "Which is the vara which is used in Porto Rico?" I would say that it is the vara of Burgos which is used, and it is equivalent to 835.905 millimeters, or 32.875 English inches.

But the Spanish Government, by the Spanish law of July 17, 1849, adopted the metric decimal system, and a few years later ordered that it be adopted in Porto Rico, and finally forbade the word "cuerda" to be used in any public document for the purchase or sale of land and established the equivalents, "Ordered, That the reduction of the cuerda to the new system be calculated at 39 ares, 30 centiares and 39 miliares." Consequently, it may be said that the cuerda is not officially used in Porto Rico, although all the Porto Ricans, in conversation and verbal contracts for the sale, purchase, or rental of land, always use the "cuerda." When, however, they go before the notary public to draw up the official written contract it is always calculated in the manner before mentioned, that is to say, each cuerda is reduced to 39 ares, 30 centiares, and 39 miliares.

From this we gather that the legal cuerda in Porto Rico is 39.339 ares, or 0.39339 hectares. The hectare is 2.471 acres, according to the Act of Congress of July 28, 1866; hence, the cuerda is 0.97212 acre.

(2.) According to a letter of February 7, from Prof. M. W. Harrington, section director at San Juan, a special investigation has, at his request, been made by Señor Don Pedro J. Fernandez with the following results:

The fundamental units are the foot or *pie* which measures 0.27863 metres or 10.9697 inches; the *vara-cuadrada*, 0.69872851 square metres, or 0.8356 square yards; the pound or *libra* of 460 grams, or 1.0141 avoirdupois pounds; the *galon* of 3.785166 litres, or closely the American wine gallon. The cuerda, which is the Porto Rican land measure and

varies, as do all Spanish measures and weights, with the notions of the seller, is popularly put at two-fifths of a *hectaria* or hectare, that is, 0.9884 of an acre. Señor Fernandez makes it 3930.35 square metres, or 0.9704 of an acre.

(3.) A letter from Prof. H. S. Pritchett, Superintendent of the Coast and Geodetic Survey, says:

As to the value of the vara used in Porto Rico. I have to say that the metric system was made obligatory in 1888, and according to the Tables of legal equivalencies, published soon after, 1 vara equals 0.835 metre. The more precise equivalent, however, is given as 1 vara equals 0.835905 metre, and 1 metre equals 1.196308 varas. This would give 1 vara equals 32.910 inches, a value differing from both the values mentioned by you, but approximating that of Burgos much more nearly than the other.

From these figures, we find the obligatory vara to be 2.7425 feet. The corresponding cuerda is 0.971243 acre.

THE WATERSPOUT OF SEPTEMBER 29.

In the September REVIEW, page 402, Mr. Henry notes a waterspout on the Mississippi coast, September 29, at 6:50 p. m.; but a recent letter from Mr. W. T. Blythe, section director, at Vicksburg, Miss., states that it was 6:50 a. m. Mr. Blythe forwards the following full description of the spout as observed by a voluntary observer, Brother Isidore, of Bay St. Louis, Miss.:

The waterspout of September 29 occurred at 6:50 a. m. I noticed the waterspout forming about three-quarters of a mile off the coast, directly in front of the college wharf, and moving rapidly west by northwest for about five minutes. When within three hundred yards of shore it veered to a northerly direction for about three hundred yards, then rose into the air, and again veered to a westerly direction, and went inland in the form of a whirlwind. Its path could be easily followed for a mile or so by the leaves and small branches it carried up with it. While off the coast it was of no violence, having passed over several bath houses without doing any damage, but, from report and observation, as soon as it struck the mainland it increased in violence, breaking off large branches from trees and overturning three small houses in the western part of the town. No news or reports were received from the interior, so damage must have been light, or the spout may have ascended into the air.

A CRUDE HYGROMETER.

A voluntary observer, Rev. W. H. Kaufman, of Oakville, Chehalis County, Wash., sends an account of his efforts to determine the moisture in the air by means of a crude form of dew-point apparatus which may be described as follows:

A 2-quart glass fruit jar with a screw top of zinc, known as Mason's patent, is provided with a pipe supplying cold water and a waste pipe so that a continuous circulation of cold water through the jar can be maintained. A stopcock in the first pipe regulates the supply. A thermometer is also hung within the jar. In order to find the dew-point, open the stopcock and admit a flow of cold water rather slowly, so that in five or ten minutes dew will begin to gather on the outside of the glass jar. At this moment read the thermometer inside of the jar. Cold water may be admitted from the city water pipes, or failing these, from a pail of water set above the jar and connected with it by a rubber tube syphon.

The Editor would remark that this arrangement must be considered as wanting in sensitiveness and delicacy, but will certainly give results correct within three to five degrees, in case of very moist atmospheres such as occur on the coast of Washington and Oregon. But in such cases the wet bulb thermometer is more convenient. One has but to provide two thermometers, one of which is to have a bit of the thinnest muslin neatly tied around its bulb and kept soaked with water. Lift this out of the water and whirl it briskly through the air for two minutes if the air is very dry, but for three or four minutes if the air is quite moist, read it quickly and we have the so-called wet bulb temperature, which is lower than the dry bulb temperature. It gives the temperature of a thin layer of water evaporating under the influence of the